PHASE I: TASK 1 REPORT

HISTORY OF LAND, TCE/SOLVENT, AND GROUND-WATER USE ON AND NEAR THE MORTON THIOKOL, INC., ELKTON DIVISION FACILITY, ELKTON, MARYLAND

PREPARED FOR:

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE
BALTIMORE, MARYLAND

AUGUST 12, 1987

GERAGHTY & MILLER, INC.
Ground-Water Consultants

TABLE 2.
LIST OF POTENTIAL POINT SOURCES OF TCE/SOLVENTS ON AND NEAR MORTON THIOKOL SITE

Site Number	Tax Map Plot No.	Name	Type	Active Dates	Owner During Active Dates	Current Owner	Type of Material	Additional Comments
Potential Sources with Documented Solvents or TCE Usage/Disposal								
S1a&b	482	Still Bottoms	Buried Drums	Late 1960s	Trinco-leased to MTI	MTI	Solvent Recovery Still Bottoms	County Health Memo-Documented disposal of drummed liquids/ sludges
S1c	482	Still Bottoms	Buried Drums	Late 1960s	Trinco	Trinco	Solvent Recovery Still Bottoms	
S2	23	Martin Herron	Buried Drums (Galaxy Waste)	No Information	M. Herron	M. Herron	Solvent Recovery Still Bottoms	There is documentation of clean up
S3a	391	Trinco Industrial Landfill	Landfill	1950s - Present	Trinco	W.L. Gore	All wastes from industrial park	Leachate analysis of seep by DHMH. TCE present
S3b	52	Trinco Industrial Landfill	Landfill	1950s	Trinco	Trinco	All wastes from industrial park	
S4	Off Map	Boulden Solvent Reclamation	Leak or Spill	? - Present	Boulden	Boulden	Septic Wastes Still Bottoms	Has a RCRA permit to store and use TCE
S5	Off Map	Maryland Sand and Gravel	Disposal into old gravel pits	1969 - 1974	--	--	Solvents Still Bottoms	Superfund site *
S6	419	Woodrow-Dare Paints	Paint Blending	1960s - 1982		City of Elkton	Solvent and Paint Sludges	MDHMD sampled drums after building burned down
S7a	169	Abandoned Propellant Open Burn Fields	Waste Disposal by Burning	Early 1950s - 1958	MTI	MTI	Propellant Waste/ Minor Amounts Solvents	EPA interested in site
S7b	127	Abandoned Open Burn Fields	Waste Disposal by Burning	1950s	Geigy	MTI	Geigy wastes	MTI has no information on the use of this site
S8	482	Incinerator Feed Surface Impoundment	Surface Impoundment	1970s	MTI	MTI	Wastewater	1-1-1,Trichloroethane, TCE in ground-water samples
S9a	Various	Waste-Propellant Storage Area	Leak or Spill	1950s - Present	MTI	MTI	Propellent Waste/ Solvents	Several potential point sources in area
S9b	Various	Vapor Degreasing Operation	Leak or Spill	1950s - Present	MTI	MTI	Propellent Waste/ Minor Amounts Solvent	Several potential point sources in area
S9c	Various	Loading Docks	Leak or Spill	1950s - Present	MTI	MTI	Solvents/Other Chemicals	Several potential point
S9d	Various	Research and Development Labs	Leak or Spill	1950s - Present	MTI	MTI	Solvents/Other Chemicals	Several potential point sources in area

TABLE 2. (Continued)
LIST OF POTENTIAL POINT SOURCES OF TCE/SOLVENTS ON AND NEAR MORTON THIOKOL SITE

Site Number	Tax Map Plot No.	Name	Type	Active Dates	Owner During Active Dates	Current Owner	Type of Material	Additional Comments
S10	52 (?)	Trinco Park Industrial Shop	Leak or Spill	? - Present	Trinco	Trinco	Solvents for cleaning machinery	
S11	482	Hydromining Wastewater Tanks	Leak or Spill	1950s - Present	MTI	MTI	Solvent/ Propellant Residue	Point source
S12	528	Crouse Bros. Excavation	Maintenance Shop	? - Present	Crouse Bros.	Crouse Bros.	Solvents for cleaning machinery	
S13	459	Ernie's Body Shop	Maintenance Shop	? - Present			Solvents for cleaning machinery	Well is clean
S14	482	Open Propellant Burn Field	Waste Disposal by Burning	1958 - Present	MTI	MTI	Solvent/ Propellant Waste	TCE in soil samples
Potential Sources with Possible Solvents or TCE Usage/Disposal								
S15	52	Trinco Park Treatment Lagoon	Surface Impoundment	1968 - Present	Trinco	Trinco	Wastewater	No permit for industrial wastes, only being monitored for conventional pollutants
S16	127	Pesticide Disposal Pit	Landfill	Unknown	?	MTI	Pesticides, Bottles of Liquid, Bags	Site currently under investigation
S17	127	Sand Pit Disposal Pit	Landfill	1970s	MTI	MTI	Photographic Wastes	Monitored by State
S18	351	Buried Beryllium Waste Disposal Area	Landfill	1960s	MTI	MTI	Waste Beryllium	Monitored by State
S19	529	Triumph Explosives Firehole	Waste disposal by burning	19337 - 1946	Triumph Explosives	MTI	Explosives Residue	Pictures show liquid from drums being poured into hole
S20	92	United Water Works	Landfill	? - Present	?	?	Construction Material	Well is contaminated with TCE
S21	127	Geigy Disposal Site	Pit	1950s	?	MTI	Unknown/ Geigy wastes	
S22	446	Triumph Explosives Loading Dock	Spill (?) Leak (?)	1943 - 1947	Triumph Explosives	MTI	Solvents/TCE Possible other chemicals also	Spills are possible at loading facilities
S23	351	Container Storage Areas	Spill (?) Leak (?)	1963 - 1969	Chemetron	MTI	Unknown	Picture showed drums stacked on covered docking area

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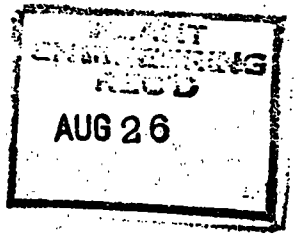

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CONCLUSIONS

G&M's historical survey has generated information that supports the position that there are a number of potential sources of TCE and trace volatile organics in the vicinity of the TCE ground-water plume on and near the Morton Thiokol, Inc., (MTI) site near Elkton, Maryland.

The most likely sources of the TCE contamination are divided into three groups: those north of Little Elk Creek and Laurel Run, those south of Little Elk Creek but north of Route 40, and those along Route 40. In order to account for the known disposal sites as well as possible disposal sites and areas where accidental leaks or spills may have occurred, all likely users of TCE or solvents were identified. The information obtained from the historical and aerial photographic surveys of land ownership indicates that there have been a total of 11 likely users of TCE or solvents north of Little Elk Creek, six south of Little Elk Creek, and four along Route 40.

The inventory of existing wells on MTI and neighboring properties resulted in a tabulation of information on 76 wells. Of these, 43 are industrial wells (ranging from small capacity drinking water to large capacity process water-supply wells), 29 are domestic wells and four are monitor wells. Twenty of 76 wells are known to be inactive, whereas 22 have yielded water samples that have TCE and traces of other compounds. Five of these 22 wells are located north of Little Elk Creek, while another 17 are located south of Little Elk Creek.

The major ground-water users in the area were identified. In the past, the largest users within the study area were Triumph Explosives and National Magnesium Corp.,

both operating in the late 1930s and early 1940s. Since the 1950s, the largest ground-water user has been MTI. Domestic well usage is collectively comparable to MTI usage, but is spread out over a larger area. Other major ground-water users within two miles of the study are, currently, the City of Elkton and Pirelli Cable Corp.

Because there are so many possible sources of TCE contamination on and near the MTI property, an ultimate determination of the most likely sources will depend on an analysis of the hydrogeology of the area during the Phase II site investigation.

INTRODUCTION

Purpose and Scope

In April 1987, Geraghty & Miller, Inc., (G&M) was retained by Morton Thiokol, Inc., (MTI) to investigate the presence of trichloroethylene (TCE) contamination in wells on and in the vicinity of the MTI plant in Elkton, Maryland. This project was undertaken as a result of a consent agreement between MTI and the Maryland Department of Health & Mental Hygiene (MDHMH) signed March 30, 1987.

The project consists of two phases. Phase I efforts are directed towards identifying all potential sources of TCE using existing data. Phase II will involve field and laboratory studies to better define TCE sources and the extent of the TCE plume. This report is a summary of Task 1 of Phase I. Task 1 included: 1) a historical survey of land use and ownership of MTI, Triumph Industrial Park and adjoining properties in the area with emphasis on identifying users and potential sources of TCE, 2) a study of low-altitude aerial photos of MTI and the surrounding area to determine when and where waste-disposal activities took place, and 3) a survey of domestic and industrial wells, as well as a history of ground-water use within the area of investigation for the purpose of identifying aquifer stresses that may have an affect on ground-water flow rate and direction.

Background

MTI is in the business of manufacturing solid propellant rocket motors and gas generators. They used TCE as a solvent for degreasing metal components from 1959 until TCE was banned by the U.S. Environmental Protection Agency in 1974.

MTI first discovered TCE in its production wells in 1984. This was the first time the well water was analyzed for volatile organics and it is not known how long the wells had been contaminated.

The discovery of TCE contamination prompted the testing of other wells in the vicinity of MTI by the MDHMH. TCE has been found in a total of 6 on-site and 16 off-site wells. The state has been conducting a sampling program of the contaminated wells since 1984. They have identified a plume of ground-water contamination that extends from the MTI G-Area, through the MTI-A Area across Nottingham Road and Rt 40. The "TCE plume," as it will be called here, contains TCE at concentrations as high as a few parts-per-million. It also includes traces of other volatile organics at selected well locations in the parts-per-billion concentration range. The full vertical and horizontal extent of the TCE plume is currently unknown. Because there are no documented TCE spills or disposal sites within or near the plume area, there is no single obvious source of TCE.

HISTORY OF LAND USE AND OWNERSHIP

There are a number of potential TCE ground-water contaminant sources on or near MTI. To identify these, G&M obtained information about past and current land use and ownership from the following sources:

- Tax assessment maps and land deeds
- Aerial photographs dating back to 1952
- MTI maps and files
- Woodward-Clyde Consultants' reports dated June 4, 1985 and October 30, 1985
- Interviews with the following persons:
  - Bill Lucas, Environmental Engineer - MTI
  - Paul Helsel, Manager of Plant Engineering - MTI
  - Larry Stork, Employee of MTI, Volunteer Fireman-City of Elkton
  - John Chlada, Inspector - MDHMH
  - Carl York, Inspector - MDHMH
  - Art O'Connell, Inspector - MDHMH
  - Mary Linda Adams, Geologist - MDHMH
  - Arlene Weiner, Geologist - MDHMH
  - Clarence Webb, Private Homeowner, Retired Owner of Webb Excavation Company
  - James Waters, Jr., Owner and Manager of Triumph Industrial Park.

Table 1 gives a summary of land ownership back to the early 1900s. Before the 1920s, the property was divided into four or five privately owned farms. Industry did not start moving into the area until the early 1930s. Locations of

TABLE 1.
HISTORY OF PROPERTY OWNERSHIP ON AND NEAR MORTON THIOKOL SITE

Plot Number	Current Owner Name/Parcel Number	Deed Number	Seller	Buyer	Date of Transaction
125	MTI	Ck 2/579	H. Biddle	C. Conner	3/03/11
		WEB 25/56	C. Conner	National Magnesium Corp.	4/23/42
		RRC 23/414	National Magnesium Corp.	R&C Macneal	4/18/42
		WAS 147/411	G&C Heintzemann	MTI	1/03/64
			(C. Macneal married G. Heintzemann)		
127	MTI				
	Parcel 1	SRA 19/351	J. Witworth	H&G Rothwell	10/03/33
		WEB 2/396	H&G Rothwell	C. Davis	4/06/36
		WEB 16/393	C. Davis	Triumph Explosives	6/18/40
		WEB 25/54	Triumph Explosives	National Magnesium	4/23/42
	Parcel 2	MD 4/120	H. Biddle	J. Conner	1905
			(J. Conner to C. Conner (will) 9/08/24)		
		WEB 25/56	C. Conner	National Magnesium	4/28/43
	Parcel 3	SRA 19/351	J. Witworth	H&G Rothwell	10/03/33
		WEB 2/396	H&G Rothwell	C. Davis	4/06/36
		WEB 16/393	C. Davis	Triumph Explosives	6/18/4
		WEB 27/522	Triumph Explosives	National Magnesium	4/28/43
	Parcel 4	RRC 1/203	F. Albanese	National Magnesium	?
	Parcel 5	RRC 17/45	Triumph Explosives	Elkton Co.	6/01/46
		RRC 21/151	J. Lewis	National Magnesium	8/31/46
	These 5 parcels combined and sold as one parcel by National Magnesium to Geigy Chemical Corp. under Deed RRC 29/195.				
	Parcel 1a	RRC 29/195	National Magnesium	Geigy Chemical Corp.	12/04/47
		WAS 23/117	Geigy Chemical Corp.	Olin Mathieson Chemical Corp.	12/28/55
	Parcel 1b	RRC 71/79	National Magnesium	Geigy Chemical Corp.	1/17/52
		WAS 23/120	Geigy Chemical Corp.	Olin Mathieson Chemical Corp.	12/28/55
	These 2 parcels (1a and 1b) combined and sold by Olin Mathieson Chemical Corp. to MTI under Deed WAS 69/421.				
		WAS 69/421	Olin Mathieson Chemical Corp.	MTI	12/30/58
169	MTI				
	Parcel 1	WEB 25/54	Triumph Explosives	National Magnesium	4/23/42
	Parcel 2	WEB 27/522	Triumph Explosives	National Magnesium	4/28/43
	Parcel 3	RRC 21/151	J.O. Lewis et al	National Magnesium	8/31/46
	These 3 parcels combined and sold to Maryland Cork Co. 4/5/50.				
		?	National Magnesium	Maryland Cork Co.	4/05/50
		RRC 70/128	Maryland Cork Co.	The Elk Corp.	12/13/51
		WAS 2/431	The Elk Corp.	Thiokol Chemical	12/14/54

GERAGHTY & MILLER, INC.

TABLE 1. (Continued)
HISTORY OF PROPERTY OWNERSHIP ON AND NEAR MORTON THIOKOL SITE

Plot Number	Name/Parcel Number	Deed Number	Seller	Buyer	Date of Transaction
301	MTI				
	Parcel 1	WHR 7/288	M. Glenn	D. Bratton	9/24/1864
	Parcel 2	WHR 7/820	M. Glenn	D. Bratton	12/29/1865
	These 2 parcels combined and sold to C. Brown under Deed SRA 24/327.				
		SRA 24/327	D. Bratton	C. Brown	3/04/35
		RRC 19/224	C. Brown	Kreer	9/30/48
		RRC 31/58	Kreer	MTI	3/30/48
351	MTI				
	Parcel 1	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 203/419	Elkton Co. (Trinco)	Chemetron Corp.	12/30/66
	Parcel 2	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 9/266	Elkton Co.	Delmar Chemical Co.	6/02/55
		WAS 144/38	Delmar Chemical Co.	Chemetron Corp.	10/31/63
	These 2 parcels combined and sold to Chemetron Corp. under Deed No. WAS 144/38.				
		WAS 248/82	Chemetron Corp.	MTI	11/26/69
446	MTI	RRC 29/85	S. Sturgeon (Elkton Co.)	Trinco	9/30/47
		WAS 346/849	Trinco	MTI	5/20/75
482	MTI				
	Parcel 1 (55.8 acres)	TAD 21/462	Sharpe	Beste	1890
		TGW 12/222	Beste	M. Brown	1/23/02
		T 27/385	M. Brown	G. Brown	9/16/36
		WEB 16/316	G. Brown	P. Zeitler	5/21/40
		WEB 20/538	P. Zeitler	Triumph Explosives	7/18/41
	Parcel 2 (24.6 acres)	TAD 21/462	Sharpe	Beste	1890
		TGW 12/222	Beste	G. Brown	1/23/02
		T 27/385	M. Brown	G. Brown	9/16/36
		WEB 25/266	P. Zeitler	Triumph Explosives	6/29/42
	Parcel 3	SRA 19/509	H. Zeitler	P. Zeitler	?
		WEB 25/348	P. Zeitler	Triumph Explosives	8/05/42
	Parcel 4 (180 acres)	WEB 14/344	J. Hughes	Decker	10/17/39
		WEB 16/20	Decker	Triumph Explosives	1/31/40
	Parcel 5	WEB 16/393	C. Davis	Triumph Explosives	6/18/40
	These 5 parcels of land combined and sold to Elkton Co. under Deed No. RRC 17/45.				
		RRC 17/45	Triumph Explosives	Elkton Co. (Trinco)	6/01/46
		RRC 29/85	S. Sturgeon (Elkton Co.)	Trinco	9/30/47
		NDS 11/612	Trinco	MTI	1/25/78

TABLE 1. (Continued)
HISTORY OF PROPERTY OWNERSHIP ON AND NEAR MORTON THIOKOL SITE

Plot Number	Name/Parcel Number	Deed Number	Seller	Buyer	Date of Transaction
529	MTI	NDS 65/22	M. Herron	MTI	3/10/81
551	MTI	?	C.M. Huester	Gilpin Manor Dev. Corp.	1973
		NDS 99/328	Gilpin Manor Dev. Corp.	MTI	6/30/83
530	M. Herron	NDS 65/22	MTI	M. Herron	3/10/81
		(Previous to 1981, Plot 530 was part of Plot 127)			
85	M. Herron	RRC 29/43	National Magnesium	G&M Schmidt	11/06/47
		WAS 324/701	G&M Schmidt	M. Herron	11/14/73
53	James E. Waters, II	NDS 75/715	J.S. Waters, Sr.	J.E. Waters, II	12/03/80
		RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/42
391	W.L. Gore	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
			Trinco	General Tire & Rubber	11/30/72
523	J. Palumbo	NDS 93/737	General Tire & Rubber	W.L. Gore	3/15/83
		RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 304/398	Elkton Co.	ACL Industries	1/02/73
		NDS 135/336	ACL Industries	J. Palumbo	2/08/85
407	Delaware Luggage	NDS 23/830	JMR	RMR	9/13/78
			(JMR amended its name to RMR)		
		NDS 78/228	RMR	Delaware Luggage	2/22/82
86	Cox	WAS 114/523	Bedford Holding Co.	G. Greenwald	1/09/62
		WAS 131/360	G&J Greenwald	E. Cox	2/21/63
393	Colonial Metals	RRC 17/45	J. Lewis	Triumph Explosives	6/01/46
		WAS 308/237	Triumph Explosives	Colonial Metals	1/05/73
538	Ray Crouse	WAS 324/407	B&C Huester	Gelpin Manor Development Corp.	11/06/78
		NDS 45/646	Gelpin Manor Development Corp.	R. Crouse	10/22/81
325	Central Chemical	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 199/61	Elkton Co.	Central Chemical Co.	9/22/66
396	ACL Industries	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 304/398	Elkton Co.	ACL Industries	1/02/73
508	Schultz Home	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		NDS 43/688	Trinco	Schultz Homes	11/08/89

TABLE 1. (Continued)
HISTORY OF PROPERTY OWNERSHIP ON AND NEAR MORTON THIOKOL SITE

Plot Number	Name/Parcel Number	Deed Number	Seller	Buyer	Date of Transaction
295	Maryland Cork	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
		WAS 76/314	Elkton Co.	Maryland Cork	5/14/59
300	P&R Railcar				
	Parcel 1	RRC 29/85	S. Sturgeon (Elkton Co.)	Elkton Co. (Trinco)	9/30/47
			Elkton Co.	Delmar Chemical Co.	7/30/51
		RRC 64/78	Delmar Chemical Co.	Stauffer Chemical Co.	7/31/51
		WAS 249/180	Stauffer Chemical Co.	Int. Min. & Chem.	12/15/69
		WAS 333/617	Int. Min. & Chem.	Trinco	6/19/74
	Parcel 2	WEB 2/396	H. Rothwell	C. Davis	4/06/36
		WEB 16/393	C. Davis	Triumph Explosives	6/18/40
		RRC 17/45	Triumph Explosives	Elkton Co.	6/01/46
		RRC 29/85	Elkton Co. (S. Sturgeon)	Trinco (Elkton Co.)	9/30/47
	These 2 plots combined and sold under Deed No. WAS 357/170.				
		WAS 357/170	Trinco	P&R Railcar	3/02/76

properties in the area are included in the most current tax maps compiled on Figure 1.

Potential sources of the TCE plume are categorized into three groups. Group 1 includes industries which have owned property in the area and have handled hazardous materials, some of which may have used, stored, or disposed of solvents including TCE. G&M was not able to collect information on all industries that leased property, therefore, this list is not complete. TCE usage has not been officially documented for most of these industries. However, industries that generally have or had manufacturing or operation/maintenance procedures that require TCE or solvent usage were identified on the basis of published information (Sittig, 1981) or on G&M's experience. Group 2 includes specific facilities where there have been known or suspected use of solvents and possible spills or disposal of waste material. These constitute individual potential point sources on the regional scale used in Figures 1 and 2. Group 3 includes disturbed areas observed on the aerial photographs that could be disposal or spill sites. Locations of Groups 2 and 3 potential TCE sources are listed in Table 2 and are shown on Figure 2.

Group 1 -- Industries

- Triumph Explosives - Triumph Explosives occupied a large portion of what is now Triumph Industrial Park and MTI (see Plots 127, 169, 482, 393, 300, 446, and 551; Figure 1). Triumph Explosives, Inc., was formed in 1933 to manufacture fireworks. The first ordnance orders were received from the U.S. Navy in 1935 and from the Army in 1938. During the transition period in the late 1930s, another party, Triumph Industries, Inc., became a prime construction contractor to the

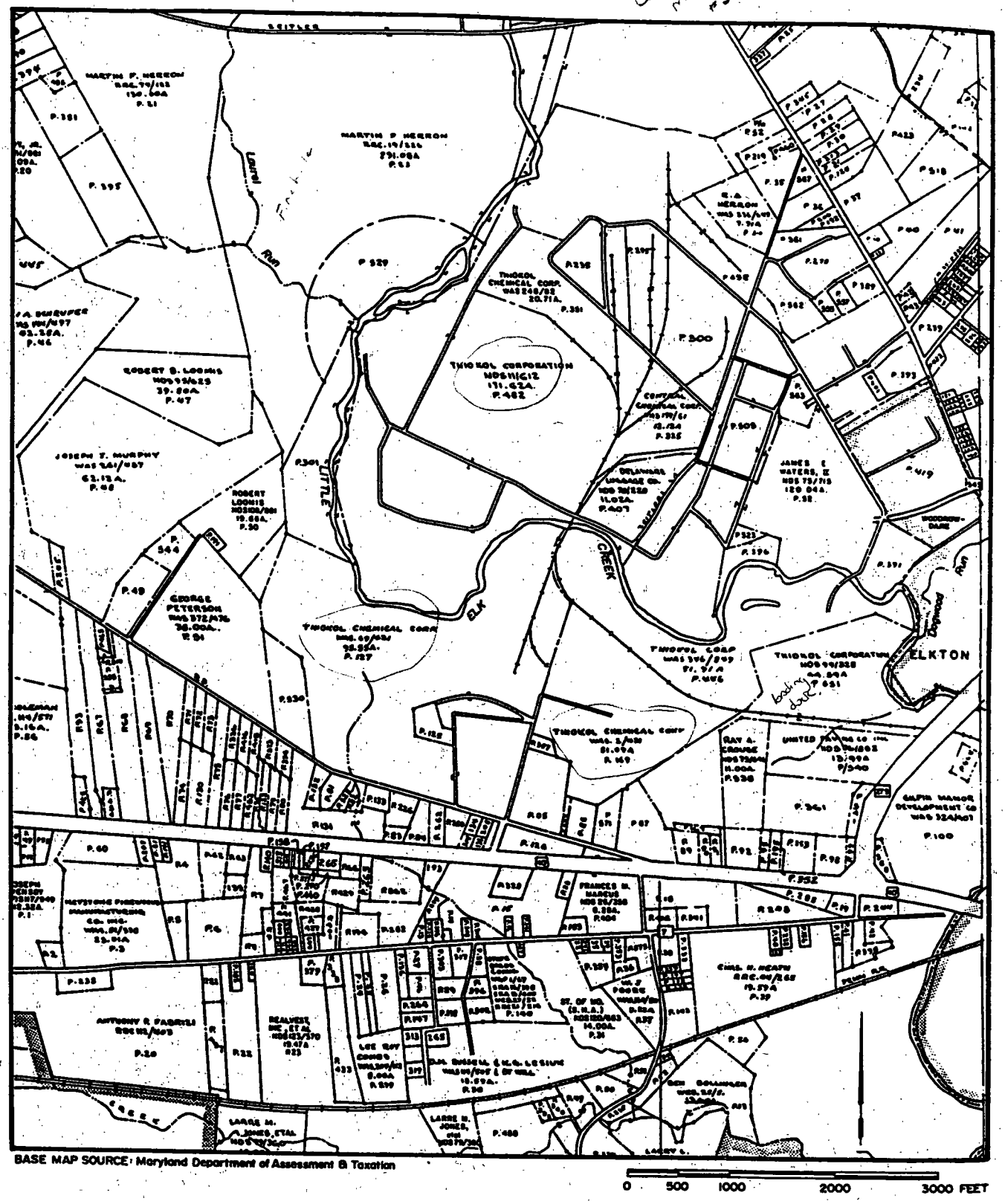
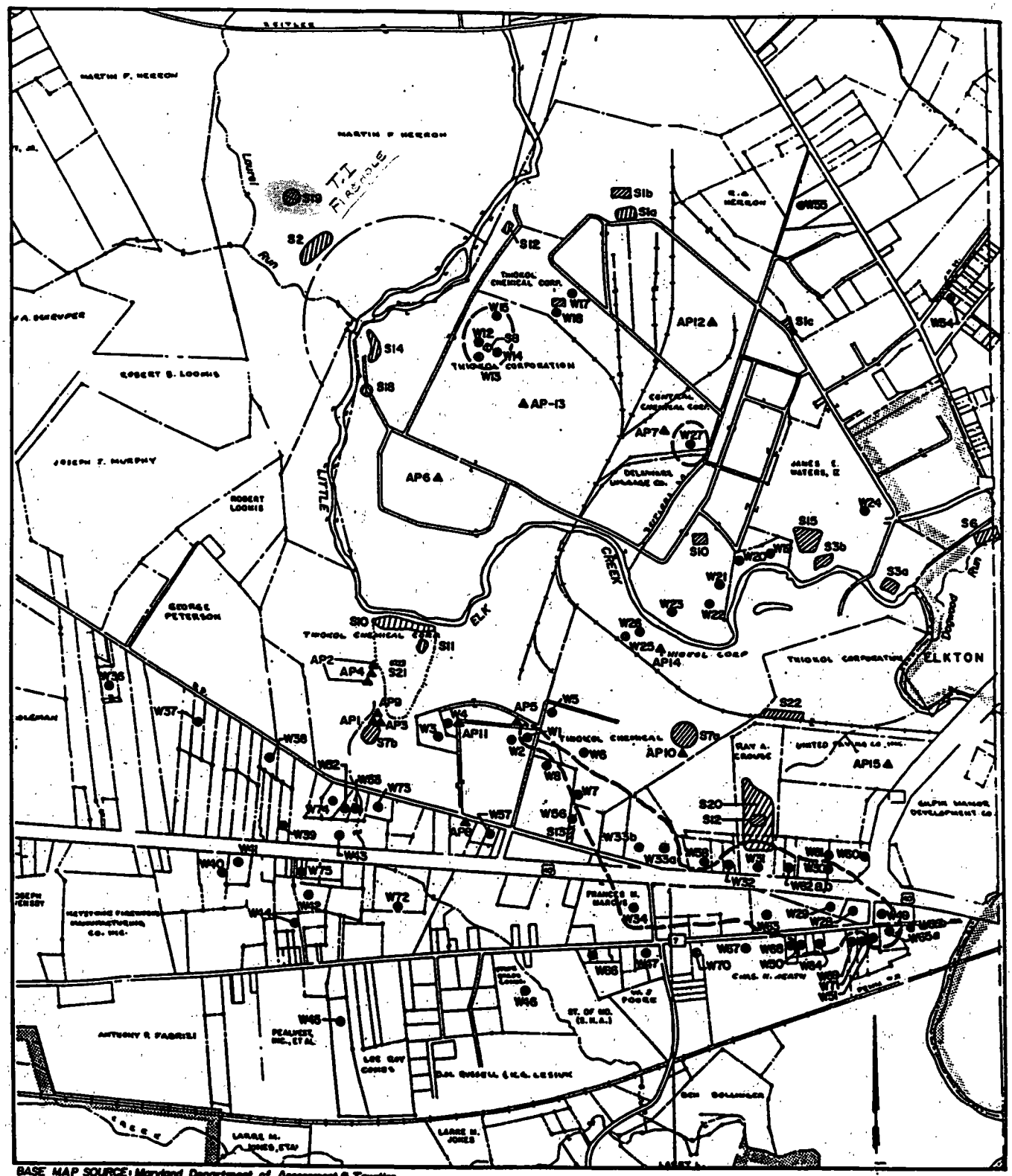


Figure 1. Locations of Taxable Properties On and Near the Morton Thiokol Site.



EXPLANATION

- ●W6 APPROXIMATE LOCATION OF EXISTING WELL WITH GERAGHTY & MILLER, INC. DESIGNATION (See Table 3)
- POTENTIAL POINT-SOURCE OF TCE/SOLVENTS (See Table 2)
- AREA ENCOMPASSING WELLS WITH KNOWN TCE/SOLVENT CONTAMINATION
- ▲AP5 AREAS OF DISTURBANCE NOTED ON AERIAL PHOTOS (Not Field Checked)

Figure 2. Locations of Potential TCE/Solvents Point Sources and Existing Water Wells On and Near the Morton Thiokol Site.

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S7b	122	Abandoned Open Burn Fields	Waste Disposal by Burning	1950s	Geigy	MTI	Geigy wastes	MTI has no information on the use of this site
S8	482	Incinerator Feed Surface Impoundment	Surface Impoundment	1970s	MTI	MTI	Wastewater	1-1-1,Trichloroethane, TCE in ground-water samples
S9a	Various	Waste-Propellant Storage Area	Leak or Spill	1950s - Present	MTI	MTI	Propellent Waste/ Solvents	Several potential point sources in area
S9b	Various	Vapor Degreasing Operation	Leak or Spill	1950s - Present	MTI	MTI	Propellent Waste/ Minor Amounts Solvent	Several potential point sources in area
S9c	Various	Loading Docks	Leak or Spill	1950s - Present	MTI	MTI	Solvents/Other Chemicals	Several potential point
S9d	Various	Research and Development Labs	Leak or Spill	1950s - Present	MTI	MTI	Solvents/Other Chemicals	Several potential point sources in area

TABLE 2. (Continued)
LIST OF POTENTIAL POINT SOURCES OF TCE/SOLVENTS ON AND NEAR MORTON THIOKOL SITE

Site Number	Tax Map Plot No.	Name	Type	Active Dates	Owner During Active Dates	Current Owner	Type of Material	Additional Comments
S10	52 (?)	Trinco Park Industrial Shop	Leak or Spill	? - Present	Trinco	Trinco	Solvents for cleaning machinery	
S11	482	Hydromining Wastewater Tanks	Leak or Spill	1950s - Present	MTI	MTI	Solvent/ Propellant Residue	Point source
S12	528	Crouse Bros. Excavation	Maintenance Shop	? - Present	Crouse Bros.	Crouse Bros.	Solvents for cleaning machinery	
S13	459	Ernie's Body Shop	Maintenance Shop	? - Present			Solvents for cleaning machinery	Well is clean
S14	482	Open Propellant Burn Field	Waste Disposal by Burning	1958 - Present	MTI	MTI	Solvent/ Propellant Waste	TCE in soil samples
Potential Sources with Possible Solvents or TCE Usage/Disposal								
S15	52	Trinco Park Treatment Lagoon	Surface Impoundment	1968 - Present	Trinco	Trinco	Wastewater	No permit for industrial wastes, only being monitored for conventional pollutants
S16	127	Pesticide Disposal Pit	Landfill	Unknown	?	MTI	Pesticides, Bottles of Liquid, Bags	Site currently under investigation
S17	127	Sand Pit Disposal Pit	Landfill	1970s	MTI	MTI	Photographic Wastes	Monitored by State
S18	351	Buried Beryllium Waste Disposal Area	Landfill	1960s	MTI	MTI	Waste Beryllium	Monitored by State
S19	529	Triumph Explosives Firehole	Waste disposal by burning	1933? - 1946	Triumph Explosives	MTI	Explosives Residue	Pictures show liquid from drums being poured into hole
S20	92	United Water Works	Landfill	? - Present	?	?	Construction Material	Well is contaminated with TCE
S21	127	Geigy Disposal Site	Pit	1950s	?	MTI	Unknown/ Geigy wastes	
S22	446	Triumph Explosives Loading Dock	Spill (?) Leak (?)	1943 - 1947	Triumph Explosives	MTI	Solvents/TCE Possible other chemicals also	Spills are possible at loading facilities
S23	351	Container Storage Areas	Spill (?) Leak (?)	1963 - 1969	Chemetron	MTI	Unknown	Picture showed drums stacked on covered docking area

TABLE 2. (Continued)
LIST OF POTENTIAL POINT SOURCES OF TCE/SOLVENTS ON AND NEAR MORTON THIOKOL SITE

Site Number	Tax Map Plot No.	Identifier	Type	Active Dates	Owner During Active Dates	Current Owner	Type of Material	Additional Comments
Potential Sources Identified on Aerial Photos with Unknown Material Usage/Disposal								
AP-1	127	EPIC - 9	Landfill	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-2	351	EPIC - 15C	Mounded Material (Two Sites)	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-3	127	EPIC - 15J	Pit with Debris	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-4	127	EPIC - 15E	Cleared Graded Land	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-5	127	EPIC - 7	Waste Pits	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-6	169	EPIC - 15A	Ground Scars	1952	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-7	325	G&M - This Study	Ground Scar	1952	Trinco	Central Chemical	Unknown	Observed on aerial photo - not listed any where else
AP-8	260	G&M - This Study	Ground Scar	1952	?	?	?	
AP-9	127	EPIC - 7 (1964)	Waste Pile	1964	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-10	169	EPIC - 9 (1964)	Landfill	1964	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-11	169	EPIC - 7 (1970)	Waste Pile	1970	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-12	300	G&M - This Study	Ground Stains	1970	MTI Trinco	MTI P&R Railcar	Unknown	Observed on aerial photo - not listed any where else
AP-13	482	EPIC - 15C (1970)	Light Toned Material	1970	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-14	127	EPIC - 6 (1975)	Surface Impoundment with Dark Toned Liquid	1975	MTI	MTI	Unknown	Observed on aerial photo - not listed any where else
AP-15	560	G&M - This Study	Ground Scar	1985				Observed on aerial photo - not listed any where else

U.S. Navy for the extensive civil works required to produce large quantities of ammunition for the war effort (Triumph Industries, Inc., 1945). Plots 446 and 551, currently owned by MTI, were used for the fabrication of high incendiary explosives. TCE was probably used for routine cleaning at a number of individual buildings. It is known that there was a separate building for degreasing operations, there were several other buildings used for painting, and still other used for maintenance of the motor pool. Management troubles caused the Navy to take over the plant under Presidential order on October 13, 1942. On February 27, 1943, the Navy returned the plant to the company. Munitions productions from the war effort continued until 1945.

- Aerial Products - Aerial Products also manufactured explosives in the late 1940s, early 1950s. It was located on both sides of Blue Ball Road on the northeast side of Trinco (see Plot 419; Figure 1).

- National Magnesium Corp. - National Magnesium was located on what is now MTI - A & G areas, as well as portions of the Martin Herron Farm (see Plots 125, 127, 169, 85; Figure 1). In operation from 1942 to 1952, National Magnesium pulverized and blended magnesium powder for use by the munitions manufacturers. National Magnesium also made Tetral, a sensitive explosive used to set off TNT.

TCE use was probably wide spread in the area at this time. Military munitions and explosives manufacturing facilities have a long history of TCE use. Because TCE only burns at high temperatures, it is considered suitable for use around explosives.

- Delmar Chemicals - Delmar Chemicals was started in 1947 by Jim Waters, Jr. Delmar Chemical manufactured aluminum chloride ($AlCl_3$), phosgene, and some organic chemicals. The site of Delmar Chemical is located on Plot 351; Figure 1. TCE and other solvents were probably used by this industry according to a former chemical engineer employee.

- Chemetron Corporation - In 1963, the Delmar Chemical phosgene plant was sold to Chemetron Corporation. Chemetron continued to manufacture phosgene. TCE was probably used at some stage in the production process. Chemetron eventually sold the property to MTI in 1969.

- Omega Chemical Corporation - After MTI purchased the Chemetron property, Omega Chemical leased a portion of the property from MTI. The lease ran from December 1969 to June 1972, when it was terminated by MTI. Omega operated a chemical dye plant. G&M was informed that a red dye spill in 1971 contaminated Little Elk Creek near Omega Chemical.

- P&R Railcar - The $AlCl_3$ manufacturing operation of Delmar Chemical was moved to what is currently the site of P&R Railcar (Plot 300; Figure 1). The plant was sold in 1952 to New York and Ohio Co., who later became Stauffer Chemicals. The property was sold to International Minerals and Chemicals in 1969. In 1974, Trinco bought the property and eventually sold it to P&R Railcar in 1976. It is alleged that up to one million pounds of $AlCl_3$ have been buried beneath the numerous railroad tracks on this site. G&M understands that excavation work on the site by

Crouse Brothers Excavation in the early 1980s encountered the buried $AlCl_3$.

It is currently being monitored by the state for a chlorobenzene contamination problem. G&M was unable to obtain any information on the results of the monitoring program. The operator of the railcar cleaning facility that currently occupies the site has a RCRA permit for storage of hazardous materials.

- Geigy Chemical Company occupied Plots 127 and 530 (see Figure 1) during the late 1940s to early 1950s. Geigy sold to Olin Mathieson Chemical Corporation in 1955. Plot 127 was acquired by MTI in 1958. Plot 530 was sold to Martin Herron in 1981. Both Geigy and Olin Mathieson custom blended pesticides and performed research and development with test plots. The exact product produced by Geigy and Olin Mathieson Chemical Companies was not determined. It is known that TCE is used in the production of fumigants (Sittig, 1981). If Geigy and Olin Mathieson produced fumigants in the time period before TCE was banned, it is possible they used TCE.

- Woodrow-Dare Paint Company - Woodrow-Dare manufactured and blended custom varnishes and paints from the 1950s to 1980s. They also ran a solvent recovery operation. The plant was located just north of the new W.L. Gore facility on the west side of Blue Ball Road just north of Dogwood Run, a tributary to Little Elk Creek. It was operated from the mid to late 60s until June 1982 when it was destroyed by fire. After the plant burned down, the state had to arrange for disposal of 80 to 90 drums containing solvents. It is possible that some of Woodrow-Dare's

paint sludges and spent solvents may have gone into the Trinco Industrial Landfill. TCE was commonly used in paint manufacturing/blending industries (Sittig, 1981) and may have been used as a solvent at this site.

- Central Chemical Company - Central Chemical, which currently occupies Plot 325 (see Figure 1), blends pesticides and herbicides with inert materials. Central Chemical's well is contaminated by industrial solvents including TCE in the ppb range. Central Chemical does not currently have a permit to use or store organic solvents; however, if they produced fumigants before TCE was banned, it is possible they used TCE.

- Crouse Brothers Excavation - Located on Plot 538 (see Figure 1), Crouse Brothers Excavation has been used for several decades as a maintenance shop for excavation vehicles and is allegedly currently using solvents for cleaning machinery. In the past it reportedly maintained and repaired HVAC units. TCE use is a possibility at this site. Crouse Brothers shares a building and a contaminated well with Universal Water Works.

- Universal Water Works - Universal Water Works is located on Rt. 40 next to Crouse Excavation. There is a landfill on this property that is owned by Crouse Excavation (Plot 538, Figure 1). It appears that mostly construction materials, bricks, tree stumps, metal pieces, etc. are dumped there. A few tanks observed were identified as oil tanks excavated from other sites. The landfill is currently active.

The beginning date is unknown. The well at Universal Water Works is contaminated with TCE.

- Ernie's Body Shop - Ernie's Body Shop is located on Nottingham Road in front of MTI (Plot 459, Figure 1). This operation would probably require a solvent for degreasing and painting activities. TCE may have been used, however, Ernie's well is not contaminated with TCE.

- Taylor Welding - Taylor Welding is located on Rt. 40 next to Steele's Motel. The well on this property is clean, however, the wells on either side of it are contaminated. The principal use of TCE is to clean and degrease machinery. Although there is no known use of TCE at this site, it is possible that in the past TCE has been used.

- United Paving - United Paving is located on Rt. 40 next to Hwy. 279. A shallow well on this site is not contaminated. A deeper well on adjoining property to the west is contaminated. There is no reported TCE use as a degreaser, however, TCE may have been used in the past.

- Boulden Solvent Reclamation Site - Boulden Solvent Reclamation is located one mile northwest of MTI along Nottingham Road. In addition to a septic cleaning service, it may have reclaimed small quanitites TCE by distillation of waste solvents. Boulden currently stores solvents in underground tanks. Dates of this operation are unknown. Boulden's well is reported to be free of any TCE contamination.

- Maryland Sand and Gravelstone - The Maryland Sand and Gravelstone site located about a mile west of MTI along Rt. 40 has a documented history of disposal of bulk liquid solvents, including spent TCE, and aqueous solutions of water and solvent into old gravel pits that were excavated down to the contact with underlying Potomac Group sediments. TCE has been documented in ground-water samples from monitor wells installed on the site (AEPCO, 1985).

- Galaxy Chemical - The Galaxy site is a solvent reclamation facility located about five or six miles upstream on Little Elk Creek. It was formerly owned by Jim Waters, Sr. and Paul Mraz, who changed the name Galaxy to Spectron, Inc. The MDHMH has been monitoring Little Elk Creek downstream from Spectron for several years. TCE is present in the stream as a minor constituent along with other solvents and organic chemicals.

In addition to the above named industrial operations, there have been many companies, about which little is known, that have leased property in the area. These industries may also be possible sources of the TCE contamination. Due to both the remote location of the MTI site, as well as unregulated disposal practices in the past, it is quite possible that unauthorized disposal took place on many portions of the property. It is, therefore, impossible to include all possible sources of the TCE contamination.

Group 2 -- Potential Point Sources

Listed below are those sites which have documented or suspected disposal or spills of waste material.

- Triumph Explosives Firehole - Reference was made to this firehole in a 1944 Triumph Newsletter. The location of the firehole is reported to be on Martin Herron's farm east of Laurel Run and north of Little Elk Creek (Site S19, Figure 2). It was used to incinerate waste explosives and possibly waste oils, fuels, and solvents. Photographs show sludge being poured from 55 gallon drums into the hole (Triumph News Topics, 1944).

- Triumph Explosives Loading Dock - A site plan for the entire munitions facility shows a loading dock along the railroad spur at the southern boundary of the facility. This potential spill site is designated S22 and is on Plot No. 551 now owned by MTI.

- MTI Still Bottoms Site - Drums of tank still bottoms containing reclaimed industrial solvents and petroleum distillates were known to have been buried between 1968 and 1969 at Site S1a on Figure 2. In addition to this known still bottoms site located on MTI property along the northern border with Maryland Cork Company, there appears to be at least two other sites where still bottoms were disposed.

  - The first is also located near the railcar cleaning facility apparently on MTI property, north of the known still bottoms site (Site S1b, Figure 2).

  - The second is alleged to be located between the Trinco Park office and the currently active Isocyanate Plant (Site S1c, Figure 2). It is alleged that land spreading of the still bottoms material was attempted at this site.

- Trinco Industrial Landfill - Two known landfills exist on Trinco property.

  - The first landfill is located near the banks of the north side of Little Elk Creek just inside Trinco Industrial Park on property now owned by W.L. Gore (Site 3a, Figure 2). The landfill is located near an old power plant that was used for making steam for the entire industrial park and may have served as an incinerator for industrial wastes. Definitely active in the 70s, the landfill may have been active as early as the 50s. In 1983, a small leachate spring at the base of the landfill was sampled and analyzed for priority pollutants. TCE was present at 410 ppb. It is believed that the landfill contains waste from Galaxy and some of the industries that were in Trinco Park at the time.

  - The second landfill is located upstream. This may in fact be joined to the first landfill; but, the second is younger and appears to still be active because it is not covered (Site 3b, Figure 2).

- Abandoned Propellant Open Burn Area-A - The abandoned burn field area (Site S7a) is located on MTI property. The area, which has not been used since 1958, currently consists of a few cleared spots in the woods. Current practice is to haul waste propellent covered with water (or fuel oil in winter) to the open burn area and solvent designated SA on Figure 2. Rags or paper contaminated by propellant are also taken there. These materials currently contain minor amounts of 1,1,1-trichloroethane and, until 1974, included TCE. This material is incinerated at high temperatures. There is probably

little risk of significant TCE contamination from the site because of the small amounts of TCE with which the material is contaminated. Any spill or leakage of TCE from the waste in the abandoned burn areas could have had to occur before incineration because TCE could probably not withstand the high temperatures of burning.

- Operational Open Burn Area-C - Located in MTI C-Area (Site S14, Figure 2), the open burn area has been in operation since 1958. TCE was detected at 60 ppb in the soil near the burn site (NUS, 1986).

- Abandoned Geigy Burn Area - Designated as Site S7b, this burn area is located in MTI G-area and was used to dispose of paper and other miscellaneous ignitable wastes which could have contained pesticides and solvents in minor amounts.

- Trinco Park Treatment Lagoon - The Trinco Park Treatment Lagoon is located as Site S15 on Figure 2. The treatment lagoon is not permitted to handle industrial wastes and is, therefore, only being monitored for conventional pollutants (i.e., total dissolved solids, etc.). The lagoon has been in operation since 1964 annd may have received unauthorized discharges of TCE and solvents.

- MTI Incinerator Feed Surface Impoundment - The lagoon is located as Site S8 on Figure 2. The waste-water lagoon liner has failed. There are three downgradient wells and one upgradient well. Concentrations of TCA has been detected in the ppm range in the downgradient wells; TCE has been detected in the ppb range in all four wells.

- Martin Herron Farm Disposal Site - Liquid still-bottom waste from the Galaxy site was hauled to Herron's farmland property on the north side of MTI. There is documentation of cleanup (i.e., removal of drums only by the MDHMH). This site is located as Site S2, Figure 2, and is a likely source of TCE and solvents.

- Geigy Drum Disposal Site - Mr. Clarence Webb, who is retired from an excavation business, is both a homeowner with a contaminated well and directly knowledgeable of waste disposal by Geigy's drummed wastes (contents unknown) in the 1950s. The approximate location of a trench containing drums is shown on Site S21 on Figure 2.

Both on and off MTI property there are areas that contain numerous minor potential sources from which leakage of small amounts of TCE could have occurred. These small potential point sources are listed below.

- Waste Propellant Storage Areas - Water- (or fuel oil) covered residue is temporarily stored in five-gallon plastic buckets outside of each of the buildings in which the waste is generated. The waste is stored near the side of the road and collected at least once a week and taken to the open-burn areas to be disposed.

- Vapor Degreasing Operation - Machined metal parts are dipped into vats that contain solvent which is heated and vaporized. Some of the vaporized solvent is captured and condensed for recycling. Approximately 20 drums of spent TCA is recovered from the 300 drums

used per year. The balance is attributed to evaporation to the atmosphere.

- Loading Docks - TCA is delivered to MTI in 55-gallon drums at the loading dock in the G-area; from there the drums are taken to the various and numerous areas where they are used. It is presumed that this practice was used for TCE up until 1974.

- Research and Development Labs - The R&D labs, located in A-area, very near the production wells, have concrete drains which used to carry the laboratory drain water down to the stream. The concrete drains are cracked and may not have entirely contained liquids flowing within them during the period when TCE was used on site.

- Trinco Industrial Shop - Upstream from Trinco's treatment lagoon (See Site S10, Figure 2) are a collection of older buildings now used as automobile mechanic and body repair shops. These buildings were alleged to be part of structures used for maintaining trucks and other vehicles. The use of solvents for machine degreasing is a real possibility at this site.

The following sites are documented disposal areas which have a contamination problem, however, TCE contamination is not suspected.

- Pesticide Disposal Pit - The pesticide pit is located as Site S16, Figure 2. This site contains bags of DDT and other pesticides, bottles of various unidentified liquids, along with containers and other

debris. Dates of operation are thought to be 1947 to 1955.

- Sand Pit Disposal Area - Beginning in 1974, photographic wastes were disposed of in the sand pit. This area is located as Site S17, Figure 2. The site is currently being monitored by the state.

- Buried Beryllium Waste Disposal Area - The Elkton Division began beryllium propellant development work in March 1962. There are no records when wastes were first buried. TCE contamination is a possibility in very small quantities (see Site S23, Figure 2).

Group 3 -- Features on Aerial Photos

As part of Task 1, G&M obtained low-altitude black and white aerial photography for most of the area encompassed by Figures 1 and 2. Stereo pairs were obtained for flights made in 1952, 1957, 1964, 1970, 1976, 1982, and 1986. These were supplemented by ground-based photographs made from various locations within the Triumph Explosives facility during the height of munitions manufacturing in the early 1940s.

Most of the Group 2 potential sources are identifiable on selected photos. In addition to these, there are areas where the vegetation has been stressed or removed and where the shallow soils have been stained, disturbed, or excavated. These sites constitute the Group 3 potential sources. G&M was not able to obtain specific information related to waste disposal or storage at these sites.

The location of sites that are within MTI property boundaries were obtained from the EPIC Report No. TS-PIC-85142. Additional disturbed areas located on property

surrounding MTI have also been identified. These and selected sites from the EPIC report are included in Table 2 and shown on Figure 2.

GROUND-WATER USE

Well Inventory

A well inventory was conducted as part of Task 1 to identify all existing industrial, domestic, and monitor wells in the study area. All available information was collected on wells located on MTI, Trinco Industrial Park, and private properties in the area. Information was obtained from the following sources:

- Woodward-Clyde Investigations - Dated June 4, 1985 and April 4, 1986
- MTI Well Files and Maps
- Maryland Geological Survey - Bulletin 21, 1958
- Maryland Geological Survey - Report on Investigations, No 39
- Current MDHMH Sampling and Monitoring Program
- Cecil County Department of Health Files
- MDHMH Computer Printout of Well Records.

G&M's inventory was not totally inclusive of all domestic wells on the south and west sides of the MTI property and does not include all wells sampled by the MDHMH in 1984. The inventory only includes those wells sampled by the MDHMH that can be located using the above list of sources.

Selected information on 76 inventoried wells is organized and summarized in Table 3. The approximate locations of the wells are shown on Figure 2. Twenty-two wells have yielded TCE-contaminated samples and are encompassed by dashed lines in the figure. As shown, there

TABLE 3.
SUMMARY OF WELL INVENTORY INFORMATION ON AND NEAR MORTON THIOKOL SITE

G&M Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W1	30		Be-457	G-1 Well 5	MTI[3]-file	MTI	MTI	40	96	Y - MTI-files - MGS-21[4]	6300 9200 2085 293 303	12/10/84 12/20/84 12/21/84 7/02/86 7/07/86
W2	34	71-0167	Be-567	G-27 Well 7	MTI-file MTI-map	Olin Mathieson/ 1955	MTI	75	121	Y - MTI-files - MGS-21 - MGS-39[5]		
W3			Be-44	G-8 Well 2	MTI-file	Geigy/1942	MTI		92	Y - MTI-files		
W4	36			G-6 Well 6	MTI-map	MTI	MTI					
W5	33			A-1	MTI-map	MTI	MTI	?	91-100			
W6	32			A-5 WCC[6]	MTI-map	MTI	MTI					
W7	31			A-4 Well 4	MTI-map	MTI	MTI		129		4010 5200 4900 1422 171 1200 13 391 1360 2.0 247 220 529 1000 1100 1000 716 867 <.1 406 1100 679 226 1040 667 818 1000 1200 937 1200 1900 1900	12/10/84 12/20/84 12/20/84 12/21/84 1/11/85 2/08/85 7/25/85 8/21/85 9/03/85 6/06/86 6/13/86 6/16/86 6/23/86 7/02/86 7/07/86 7/25/86 8/01/86 8/18/86 9/02/86 9/15/86 9/22/86 9/29/86 10/06/86 10/18/86 11/03/86 12/01/86 1/05/87 1/12/87 1/30/87 3/ /87 4/10/87 5/01/87

1 - Maryland Department of Natural Resources
2 - Maryland Geological Survey
3 - Morton Thiokol, Inc.
4 - Maryland Geological Survey-Bulletin 21
5 - Maryland Geological Survey Report of Investigations No. 39
6 - Woodward-Clyde Consultants Report of June 4, 1985
7 - Maryland Department of Health and Mental Hygiene
8 - Not detected; equivalent to "NDL", "0", and "Neg" as reported by WCC and MDHMH

TABLE 3. (Continued)
SUMMARY OF WELL INVENTORY INFORMATION ON AND NEAR MORTON THIOKOL SITE

G&M Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W8			Be-28		MTI-files MGS-21	Schmidt/ 1947	MTI		91	Y - MTI-files - MGS-39		
W9			Be-31		MTI-files MGS-21	Geigy/1942	MTI		107	Y - MTI-files - MGS-39		
W10			Be-29		MTI-files MGS-21	MTI/1942	MTI		75	Y - MTI-files		
W11			Be-30		MTI-files MGS-21	MTI/1942	MTI		107	Y - MTI-files		
W12	45	73-3380		MW-1	WCC	MTI	MTI	1	16		19.9 287	1/11/85 6/24/86
W13	46	73-3381		MW-2	WCC	MTI	MTI	2	16		71.0 <250	1/11/85 6/24/86
W14	44			MW-3	WCC	MTI	MTI	2	16		30.4 <1 37.2	1/11/85 12/11/85 6/24/86
W15	47			MW-4	WCC	MTI	MTI		16		76.2 290 76.3	1/11/85 6/24/86 12/11/85
W16	35			Abandoned Area G								
W17				Delmar - 1	MTI-files	Delmar Chemical	MTI					
W18				Delmar - 2	MTI-files	Delmar Chemical	MTI					
W19	38			Trinco Well-1	WCC	Trinco/ 1940s	Trinco	26	23			
W20	39			Trinco Well-2	WCC	Trinco/ 1940s	Trinco	26	22			

TABLE 3. (Continued)
SUMMARY OF WELL INVENTORY INFORMATION ON AND NEAR MORTON THIOKOL SITE

G&M Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W21	40			Trinco Well-3	WCC	Trinco/ 1940s	Trinco	32	28			
W22	41			Trinco Well-4	WCC	Trinco/ 1940s	Trinco	44	38			
W23	42			Trinco Well-5	WCC	Trinco/ 1940s	Trinco	23	20			
W24	37			Trinco Well-6	WCC	Trinco	Trinco					
W25				Trinco Well-7	MTI	?	Trinco					
W26				Trinco Well-8	MTI	?	Trinco					
W27	43			Central Chemical	WCC	?	Central Chemical		40-60?		8	4/03/85
W28	17				WCC		Countryside Auto				10	7/21/87
											23	1/09/85
											24	1/29/85
											32	7/30/85
											7	6/25/86
											23	5/02/86
											53.9	8/29/86
											26	7/23/87
W29	18				WCC		Nationwide Insurance		100		99	12/28/84
											99	1/23/85
											120	1/29/85
											90	7/31/85
											32.3	9/10/86
											18	7/23/87
W30	21				WCC		C. Webb/shares well with United Paving		70		1500	1/09/85
											650	7/31/85
											1600	6/04/86
											1300	6/18/86
											3073	8/18/86
											1800	9/05/86
											1340	7/23/87
W31	23	81-0272			WCC	1982	Crouse Brothers/shares with Universal Water Works	6	60	Y	130	1/09/85
											103	1/10/85
											128	8/15/85
											220	5/02/86
											423	8/19/86
											124	7/23/87

TABLE 3. (Continued)
SUMMARY OF WELL INVENTORY INFORMATION
ON AND NEAR MORTON THIOKOL SITE

G&N Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W32	24				WCC		S. Butler		987		1	1/09/85
W33a	26				WCC		Steel's Motel		1007		280	12/20/84
											263	12/26/84
											267	7/23/87
W33b					WCC		Steel's Motel		70		390	8/25/86
W34	48	73-3701			WCC		F. Marcus (Little Elk Inn)	12	91	Y	2	12/26/84
											3	6/18/86
W35	1	72-2697			WCC		A. Eklund	5	307	Y	ND[3]	1/09/85
W36	2	81-0150			WCC		R. Payne		65	Y		
W37	3	81-0487			WCC	1982	B. Ansalvish	20	206	Y		
W38	4				WCC		R. Biddle		140	Y	ND	1/09/85
W39	6	78-0027			WCC		Fellowship Baptist	3	95	Y		
W40	7	81-0499			WCC	1982	F. Smith	15	101	Y		
W41	8	73-0342			WCC		F. Smith Apts.	15	100	Y		
W42	9	73-3081			WCC		R. MacIntosh	35	104	Y		
W43	10	73-24-96			WCC		Davis Concrete	30	88	Y		
W44	11	73-2795			WCC		G. Bonsall	12	95	Y		
W45	12				WCC		Forest View					
W46	13	81-1832			WCC	1985	St. Hwy. Admin.	30	74	Y	ND	12/20/84
W47	14	73-2950			WCC	1979	Bartons Tavern	30	80	Y	ND	12/20/84
W48	15	73-1676			WCC		G. Slagle	10	37	Y		
W49	16				WCC		H&R Block (Elkton Verterinary Center)				26	1/29/85
											24	2/15/85
											25	5/02/86
											65	8/29/86
											98	7/23/87

TABLE 3. (Continued)
SUMMARY OF WELL INVENTORY INFORMATION
ON AND NEAR MORTON THIOKOL SITE

G&M Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W50	51	73-2880			WCC	1979	M. Wisnewski	30	107	Y	60	2/15/85
											40	6/20/86
											138	8/25/86
W51	52				WCC		C. Schirling	60			10	2/15/85
											6	8/30/85
											22	8/29/86
											24	7/23/87
W52	53	73-3889			WCC	1981	J. Aro	20	76	Y	ND	1/09/85
											ND	4/02/86
W53	54	73-2243			WCC		J. Aro	5	44	Y		
W54	49	73-3798			WCC		M. Leffew	2	300	Y		
W55	50	81-0683			WCC	1983	A. Justice	15	125	Y		
W56	27				WCC		Ernie's Body Shop		1007		ND	12/20/84
											ND	12/26/84
											ND	1/11/85
W57	29				WCC		J. Harmon		207		ND	12/26/84
W58	25				WCC		Taylor Welding		607		ND	1/03/85
W59	5	73-2562			WCC		N. Robinson	7	85	Y		
W60	19				WCC				307		ND	12/20/85
W61	20				WCC		United Paving (C. Webb)		307		ND	1/09/85
											(for deep well, see C. Webb; W30)	
W62a	22	81-0856			WCC	1983	C. Dennison	12	82	Y	2400	6/04/86
											2311	7/23/87
W62b							C. Dennison		Shallow	N	ND	1/16/85

TABLE 3. (Continued)
SUMMARY OF WELL INVENTORY INFORMATION
ON AND NEAR MORTON THIOKOL SITE

G&M Map Number	Woodward-Clyde Map Number	DNR[1] Permit Number	MGS[2] Permit Number	Other Identifying Numbers	Source of Map Location (see index)	Original Owner/Date Completed	Current Owner	Well Yield (gpm)	Well Depth (ft)	Well Log	TCE Concentration (ppb)	Date Sampled
W63		72-0271			MDHMH[7] Well 1		C. Norman	9	98	Y	47	4/02/86
											80.6	8/25/86
											34	7/23/87
W64					MDHMH Well 2		D. Pennington				20	5/02/86
											42	8/29/86
W65a					MDHMH Well 5		I. Conley				32	6/20/86
											70	8/29/86
											39	7/23/87
W65b							I. Conley		Spring		ND	6/20/86
W66					MDHMH-Map		T. Mitchem				ND	?
W67					MDHMH-Map		C. Heath				ND	6/04/86
W68					MDHMH-Map		W. Nickle				ND	3/07/85
W69					MDHMH-Map		J. Nickle				ND	6/26/86
W70					MDHMH-Map		R. Powers				ND	6/04/86
W71					MDHMH-Map		P. Cornell				ND	6/20/86
W72					Tax Map		Newark Concrete				ND	6/04/86
W73					Tax Map		J. Baker				ND	4/02/86
W74					Tax Map		A. Chamers				ND	4/02/86
W75					Tax Map		W. Simmons				ND	6/04/86

are two small TCE plume areas north, and one major area south, of Little Elk Creek. It is possible that more extensive sampling from new and existing (unsampled) wells will greatly extend these areas.

History of Water Use

The major sources of ground water in the study area are the Potomac formation aquifers of Cretaceous age and the younger, surficial Quaternary alluvium along Little Elk Creek. Ground-water flow in the uppermost aquifer generally follows the topography while flow in the deeper aquifers generally follows the south-southeast dip of the sediments.

Ground-water pumping can locally alter the direction and rate of ground-water flow. It is, therefore, important to have both historical and current information on pumpage rates and volumes. Those operations that presently use the largest amount of ground water are listed below. All are located within two miles of MTI, and all use ground-water obtained from the Potomac aquifer (Maryland Department of Natural Resources, 1986).

Name	Average Ground-Water Appropriation (GPD)
City of Elkton	800,000
Morton Thiokol, Inc.	35,000
Pirelli Cable Corp.	48,000
Davis Concrete Co., Inc.	8,000
Elkton Homes, Inc.	6,000
Central Chemical Corp.	4,000
Fred Smith	7,600

Historically, Triumph Explosives and National Magnesium have probably been the largest users of ground water in the area. In operation from approximately 1933 to 1946, Triumph was a very large manufacturer of munitions for World War II. Water used in the plant was obtained from two sources. Eight

dug wells in the Quaternary alluvium had a combined maximum capacity of 1700 gpm. The City of Elkton supplied approximately 500,000 gallons of water per day, which was probably pumped from their well field located several miles east.

Until 1984, MTI had been supplied by Potomac aquifer wells located on its property. In 1984, when TCE was discovered in these production wells, MTI stopped pumping and began to obtain water from the City of Elkton. Pumping resumed in 1986. Currently, MTI uses approximately 35,000 gallons of water per day.

Triumph Industrial Complex (Trinco) currently, and in the past, obtained its water directly from the City of Elkton. However, Trinco is investigating the possibility of reactivating the abandoned Triumph Explosives wells on its property (Woodward Clyde Consultants, 1985b). A ground-water appropriation permit for an average of 250,000 gpd has been issued to them by the DNR. As of the end of 1986, they have not made use of the permit.

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Order quads

Bay View 1970PR (76-1)

Newark West 1940-53 (70 PR)

North East 1970RR (76-1)

Elkton 1970 PR (76-1)